

U. S. DEPARTMENT OF COMMERCE

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BUREAU OF STANDARDS

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CIRCULAR OF THE BUREAU OF STANDARDS, No. 390

(Supersedes second edition of Circular No. 139)

AMERICAN STANDARD SPECIFICATIONS
FOR DRY CELLS AND BATTERIES

Issued December 10, 1930

Approved September 9, 1930
by the American Standards Association

The American Standards Association designation is C18-1930



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1930

FOREWORD

Specifications for dry cells, prepared by the National Bureau of Standards with the cooperation of manufacturers and users, were first published as an appendix to the Bureau's Circular No. 79, Electrical Characteristics and Testing of Dry Cells. They were later promulgated by the Federal Specifications Board as its specification No. 58 and were issued separately in the Bureau's Circular No. 139. The second edition was approved by the American Engineering Standards Committee (now American Standards Association) as American Standard, February 27, 1928.

Since that date a revision has been carried out concurrently by a technical committee of the Federal Specifications Board and a sectional committee working under the procedure of the American Standards Association. The specifications prepared by the two committees differ in arrangement, but are identical in substance, excepting certain general clauses regarding purchasing procedure which are incorporated in all Federal specifications. This circular gives the specifications in the form adopted by the sectional committee and approved by the American Standards Association under its No. C18-1930.

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(American Standard C18—1930)

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I. DEFINITIONS

Dry cells and batteries to be included under this specification shall fulfill the following requirements in addition to the other paragraphs of this specification:

1. The cells shall be of sal ammoniac type with depolarizer.
2. The cells shall have a nonspillable electrolyte and be free from leakage during the useful life of the cell.

II. NOMENCLATURE

For reference in connection with this specification, the following system of nomenclature shall be used to designate sizes and types.

(a) The large cylindrical dry cell, 2½ by 6 inches (63 by 152 mm), shall be designated as No. 6. Smaller cells shall be designated by the letters A to F in accordance with Table 1, which gives nominal dimensions of the zinc container.

TABLE 1

Designation ¹	Diam-eter	Height	Diam-eter	Height	Designation ¹	Diam-eter	Height	Diam-eter	Height
	<i>Inches</i>	<i>Inches</i>	<i>mm</i>	<i>mm</i>		<i>Inches</i>	<i>Inches</i>	<i>mm</i>	<i>mm</i>
A.....	5⁄8	1 7⁄8	16	48	D.....	1 1⁄4	2 1⁄4	32	57
B.....	3⁄4	2 1⁄8	19	54	E.....	1 1⁄4	2 7⁄8	32	73
C.....	1 1⁄16	1 13⁄16	24	46	F.....	1 1⁄4	3 7⁄16	32	87

¹ Includes flat cells of equivalent capacity.

(b) Flash-light, radio, and similar batteries which consist of more than one cell shall be designated by a style letter indicating the shape or other designation of the battery; a number indicating the number of cells contained; and finally a letter indicating the size of cell according to Table 1. The style letters are as follows:

Style letter	Shape or other designation of battery
T-----	Tubular batteries; one line of cells, end to end, primarily for flash-light use.
G-----	Group batteries, primarily railway-lantern batteries.
H-----	Horizontal batteries; one horizontal row or layer of cells primarily for radio use.
V-----	Vertical batteries; cells arranged in layers, one layer above another, primarily for radio use.

(c) Assembled batteries, containing No. 6 cells, shall be designated by letters and numbers. The first number designates the number of cells in the battery and the second number the size of cell, followed by the letter S or the letter D, according to the arrangement of the cells in a single or double row.

III. TYPES OF CELLS AND BATTERIES

The following types of dry cells and batteries are included in this specification:

- No. 6 dry cells, general-purpose type.
- No. 6 dry cells, telephone type (light service cells).
- No. 6 dry cells, radio A type.
- Assembled batteries of No. 6 cells.
- Flashlight cells and batteries.
- Radio B batteries.
- Radio C batteries.

IV. STANDARD SIZES OF CELLS AND BATTERIES

(a) No. 6. DRY CELLS.—The dimensions for the zinc container of the cell, measured without the jacket, are: Diameter, $2\frac{1}{2}$ inches (63 mm); height, 6 inches (152 mm).

Deviations shall not exceed $\frac{1}{16}$ inch (1.6 mm) in diameter and $\frac{1}{8}$ inch (3.2 mm) in height from the dimensions as given in inches. The over-all dimensions including the jacket and terminals shall not exceed: Height, $6\frac{3}{4}$ inches (171 mm); diameter, $2\frac{5}{8}$ inches (67 mm).

(b) ASSEMBLED BATTERIES OF No. 6 CELLS.—

TABLE 2

Designation	Assembly	VOLT- AGE	Maximum dimensions					
			Length	Width	Height	Length	Width	Height
		<i>Volts</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>
46S-----	4 cells, single row-----	6	10 $\frac{5}{8}$	2 $\frac{3}{4}$	7 $\frac{1}{2}$	270	70	190
46D-----	4 cells, double row-----	6	5 $\frac{5}{8}$	5 $\frac{5}{8}$	7 $\frac{1}{2}$	137	137	190
56D-----	5 cells, double row-----	7 $\frac{1}{2}$	8	5 $\frac{5}{8}$	7 $\frac{1}{2}$	203	137	190
66D-----	6 cells, double row-----	9	8	5 $\frac{5}{8}$	7 $\frac{1}{2}$	203	137	190

(c) FLASHLIGHT BATTERIES.—These batteries contain cells of sizes given in Table 1.

TABLE 3

Designation	Maximum dimensions				Minimum dimensions			
	Diameter	Height	Diameter	Height	Diameter	Height	Diameter	Height
	<i>Inches</i>	<i>Inches</i>	<i>mm</i>	<i>mm</i>	<i>Inches</i>	<i>Inches</i>	<i>mm</i>	<i>mm</i>
C.....	1 $\frac{1}{32}$	13 $\frac{1}{32}$	26	50	3 $\frac{1}{32}$	1 $\frac{1}{8}$	25	48
D.....	1 $\frac{1}{32}$	21 $\frac{1}{32}$	34	61	1 $\frac{1}{32}$	2 $\frac{3}{16}$	33	59
T2C.....	1 $\frac{1}{32}$	31 $\frac{1}{16}$	26	100	3 $\frac{1}{32}$	3 $\frac{3}{4}$	25	95
T2D.....	1 $\frac{1}{32}$	41 $\frac{1}{16}$	34	122	1 $\frac{1}{32}$	4 $\frac{3}{8}$	33	117
T3D.....	1 $\frac{1}{32}$	7 $\frac{1}{32}$	34	183	1 $\frac{1}{32}$	6 $\frac{1}{16}$	33	176
G4F.....	1 3 $\frac{3}{8}$	2 4	86	102	-----	2 3 $\frac{3}{16}$	-----	97

¹ Maximum diagonal measurement on this battery, which is to pass through a circle 3 $\frac{3}{8}$ inches (86 mm) diameter.

² Body height exclusive of terminals.

(d) RADIO B BATTERIES.—These batteries commonly contain cells of standard sizes given in Table 1, the cells being connected in series.

TABLE 4

Designation	Maximum dimensions of battery							
	Length	Box height	Over-all height	Width	Length	Box height	Over-all height	Width
	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>
H15A.....	3 $\frac{1}{4}$	21 $\frac{1}{16}$	3 $\frac{1}{16}$	2 $\frac{3}{16}$	89	68	87	56
H15B.....	4 $\frac{1}{4}$	2 $\frac{3}{4}$	3 $\frac{1}{4}$	2 $\frac{3}{8}$	108	70	83	67
H15D.....	61 $\frac{1}{16}$	3 $\frac{3}{16}$	31 $\frac{1}{16}$	4 $\frac{1}{16}$	173	81	100	106
V30D.....	8 $\frac{1}{4}$	7 $\frac{3}{8}$	71 $\frac{1}{16}$	3 $\frac{3}{16}$	210	186	202	84
V30F.....	8 $\frac{1}{4}$	7 $\frac{3}{8}$	71 $\frac{1}{16}$	4 $\frac{1}{2}$	210	187	202	114

(e) RADIO C BATTERIES.—These batteries commonly contain cells of standard sizes given in Table 1, the cells being connected in series.

TABLE 5

Designation	Maximum dimensions of battery							
	Length	Box height	Over-all height	Width	Length	Box height	Over-all height	Width
	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>
H3B.....	2 $\frac{1}{2}$	2 $\frac{1}{16}$	3	1 $\frac{1}{8}$	63	65	76	22
H5B.....	4 $\frac{1}{4}$	2 $\frac{3}{4}$	3 $\frac{1}{4}$	1 $\frac{1}{16}$	108	70	83	24
H15D ¹	4 $\frac{1}{16}$	3 $\frac{3}{16}$	31 $\frac{1}{16}$	1 $\frac{1}{2}$	103	81	100	38
H15D ¹	-----	-----	-----	-----	-----	-----	-----	-----

¹ Batteries used as B batteries and also as C batteries shall be marked as B batteries with a statement indicating how they may be used as C batteries. See Table 4 for dimensions.

V. MATERIAL AND WORKMANSHIP

The material and workmanship shall be first class in every particular. Cells or batteries having any of the following defects shall be considered as not complying with this part of the specification: Loose terminals, spring clips which do not make and maintain positive connections to the external circuit, high or low carbons, corrosion at brass cap on carbon rods, carbon rods off center, loose or cracked seals, leaking or distorted zinc containers.

VI. JACKETS

The individual cells, except those in assembled batteries, flash-light batteries, and radio batteries, shall be inclosed in a close-fitting jacket of news, chip, or straw board. Paraffined or waxed jackets may be specified for special purposes.

VII. MARKING

On the outside of the jackets of individual cells and outside of batteries shall be printed the following information:

The trade name of the cell.

The name of the manufacturer or such trade-mark as will identify the manufacturer.

Number or other designation of size.

The date of manufacture or the expiration of a guaranty period. (Optional: This may be on zinc container.)

VIII. ZINC

The anode shall be made from smooth zinc, free from flaws, blisters, and cracks.

IX. SEALING COMPOUND

The sealing compound shall be an insulating material which shall not flow at a temperature of 45° C. (113° F.) during a static test of 24 hours' duration. When required and specified for batteries containing 15 cells or more, the sealing compound, conforming to the above specification, shall fill the interstices between the individual cells as well as the space above the cells up to and flush with the top edge of the battery.

X. TERMINALS AND CELL CONNECTIONS

(a) No. 6 CELLS.—The terminals shall be of brass of the knurled nut-and-screw type (thread 8-32), or spring clips shall be furnished as specified. The terminals shall not be obstructed by the cardboard jacket, solder, or protruding material of the seal.

(b) ASSEMBLED BATTERIES OF No. 6 CELLS (TABLE 2).—The batteries shall have soldered connections between the individual cells. The terminals shall be brought through the top of case or sealing material to binding posts or spring clips. The polarity of the terminals shall be marked.

(c) FLASH-LIGHT CELLS (TABLE 3).—The brass cap on the carbon rod and the zinc bottom of flash-light cells or unit-cell flash-light batteries serve as the terminals, and they shall be clean to insure good electrical contact.

(d) FLASH-LIGHT BATTERIES (TABLE 3).—The cells in tubular batteries are assembled end to end. The brass cap on carbon rod of the top cell is one terminal, the other terminal being the zinc bottom of the lowest cell. The connections between cells of lantern batteries shall be soldered and the terminals shall be of spring brass brought through the cover at the top. The point of contact of one terminal shall be at the center and that of the other 1 inch from it.

(e) **RADIO B BATTERIES (TABLE 4).**—These batteries shall have soldered connections between the individual cells. The terminals shall be of brass of the knurled nut-and-screw type (thread 8-32) or spring clips as specified. The negative terminal shall be marked by a minus sign (−) and each positive or intermediate terminal with a plus sign (+) and the nominal voltage.

When wire terminals are required and specified, they shall consist of flexible tinned copper conductor equivalent to No. 18 Brown & Sharpe gage, rubber insulated and covered with single cotton braid. The positive terminal shall have a red braid and the negative terminal a black braid. Wire leads shall be 6 inches long.

(f) **RADIO C BATTERIES (TABLE 5).**—These batteries shall have soldered connections between the individual cells. The terminals shall be the same as described in section (e) for B batteries, except for the marking which shall be as follows: The positive terminal shall be marked with a plus sign (+) and each negative or intermediate terminal with a minus (−) and the nominal voltage.

XI. VOLTAGE TESTS

The voltage of individual cells shall be not less than the values shown in Table 6 when measured with a voltmeter having a resistance of not less than 100 ohms per volt and having not less than 50 divisions of its scale per volt.

The voltage of batteries of two or more cells shall be not less than the product of the required minimum voltage per cell by the number of cells in the battery when measured with a voltmeter having a resistance of not less than 100 ohms per volt and having at least 10 divisions of its scale per volt. The voltage of radio batteries for the plate (B) circuit and for the grid (C) circuit shall be measured with a voltmeter having not less than 50,000 ohms resistance and a scale having not less than 5 divisions per volt.

TABLE 6

Designation	Nominal dimensions of cell		Minimum voltage	Designation	Nominal dimensions of cell		Minimum voltage
	Diameter	Height			Diameter	Height	
	<i>Inches</i>	<i>Inches</i>			<i>Inches</i>	<i>Inches</i>	
No. 6.....	2½	6	1.50	C.....	1½ ¹⁶	1½ ¹⁶	1.49
F.....	1¼	3¾ ¹⁶	1.50	B.....	¾	2½	1.48
E.....	1¼	2¾	1.50	A.....	¾	1¾	1.47
D.....	1¼	2¼	1.50				

XII. CAPACITY TESTS

The size and kind of dry cell or battery and the conditions of service shall determine the kind of test to be applied. The test which best represents any particular service is that which covers approximately the same duration of time. Intermittent tests are preferred to continuous tests and shall be used wherever possible, since there is no direct relation between the results of continuous tests and intermittent tests of longer duration.

Cells shall be free from leaks during the period of test. The standard temperature for tests is 20° C. (68° F.). Deviations

from this temperature shall be stated. The resistance of the discharge circuit shall be maintained to within 0.5 per cent of its nominal value.

To determine compliance with this specification, those tests shall be applied for which requirement figures are given in Tables 7, 8, 9, and 10.

In the tests described below the frequency of readings specified for each test relates to the larger and more commonly used sizes of cells and batteries. When the smaller sizes are tested, more frequent readings are required.

(a) *INTERMITTENT TESTS.*—(1) *Light intermittent test.*—Three cells connected in series shall be discharged through 20 ohms resistance for 10 periods of 4 minutes each at hourly intervals during 6 days per week. On the remaining day every other discharge period shall be omitted. (There are 65 such discharge periods per week, or a total weekly service of 260 minutes.)

The following readings shall be taken: Initial open-circuit voltage of the battery. Initial closed-circuit voltage of the battery. Closed-circuit voltage at the end of a discharge, after 7 days, and every 7 days thereafter until the voltage falls below 3.5 volts, following which a reading shall be taken each working day.

Readings shall be made on a day having 10 discharge periods and, if possible, at the end of the last discharge period for the day.

The test is considered completed when the closed-circuit voltage of the battery has fallen below 2.8 volts. The service shall be reported as the total days on test to this cut-off voltage.

(2) *Heavy intermittent test.*—Four cells, connected in series, shall be discharged through 10% ohms resistance for two periods of 1 hour each daily. The discharge periods shall be not less than 6 hours apart.

The following readings shall be taken: Initial open-circuit voltage of the battery. Initial closed-circuit voltage of the battery. Closed-circuit voltage every other working-day thereafter at the end of the second discharge period of the day.

The test is considered completed when the closed-circuit voltage at the end of a period of discharge falls below 3.4 volts. The service shall be reported as the hours of actual discharge to this cut-off voltage.

(3) *Flash-light intermittent test.*—The battery shall be discharged for 5-minute periods, at 24-hour intervals, through a resistance of 4 ohms for each cell in series in the battery.

The following readings shall be taken: Initial open-circuit voltage of the battery. Initial closed-circuit voltage of the battery. Closed-circuit voltage of the battery at the end of a discharge period twice each week thereafter.

The test is considered completed when the closed-circuit voltage at the end of a period of discharge falls below 0.75 volt per cell. The service shall be reported as the minutes of the actual discharge to this cut-off voltage.

(4) *Radio A heavy service test.*—Three cells connected in series shall be discharged at a constant current of 0.25 ampere for a continuous period of 4 hours on each of 6 days per week, with intervals of not less than 16 hours intervening between the discharge periods.

The following readings shall be taken: Initial open-circuit voltage of each cell. Initial closed-circuit voltage of each cell. Closed-circuit voltage readings at the end of each discharge period.

The test is considered completed when the closed-circuit voltage at the end of a period of discharge falls below 0.9 volt per cell. The service shall be reported as the hours of actual discharge to this cut-off voltage.

(5) *Radio A light service test.*—Three cells connected in series shall be discharged at a constant current of 0.125 ampere for a continuous period of 2 hours on each of 6 days per week, with intervals of not less than 16 hours intervening between the discharge periods.

The following readings shall be taken: Initial open-circuit voltage of each cell. Initial closed-circuit voltage of each cell. Closed-circuit voltage at the end of the third and sixth discharge periods of each week.

The test is considered completed when the closed-circuit voltage at the end of a period of discharge falls below 0.9 volt per cell. The service shall be reported as the hours of actual discharge to this cut-off voltage.

(6) *Radio B 5,000-ohm intermittent test.*—Each 22½-volt (nominal voltage) battery unit shall be discharged through a resistance of 5,000 ohms during a continuous period of 4 hours on each of 6 days per week, the intervals between successive discharge periods being not less than 16 hours.

The following readings shall be taken: Initial open-circuit voltage of the battery. Initial closed-circuit voltage of the battery. Closed-circuit voltage readings at the end of the second, fourth, and sixth discharge periods of each week.

The test is considered completed when the closed-circuit voltage at the end of a period of discharge falls below 17 volts. The service shall be reported as the number of hours of actual discharge to this cut-off voltage.

(7) *Radio B 1,250-ohm intermittent test.*—This test shall be as specified in paragraph (6) above with the exception that 1,250 ohms shall be used in place of 5,000 ohms.

(b) **CONTINUOUS DISCHARGE TESTS.**—(1) *Radio B 5,000-ohm continuous test.*—Each 22½-volt (nominal voltage) battery unit shall be discharged continuously through a resistance of 5,000 ohms.

The following readings shall be taken: Initial open-circuit voltage of the battery. Initial closed-circuit voltage of the battery. Closed-circuit voltage daily.

The test is considered completed when the closed-circuit voltage of the battery falls below 17 volts. The service shall be reported as the number of hours of discharge to this cut-off voltage.

(2) *10-ohm continuous test.*—Cells of the No. 6 size shall be discharged continuously through a resistance of 10 ohms per cell.

The following readings shall be taken: Initial open-circuit voltage of the cell or battery. Initial closed-circuit voltage of the cell or battery. Closed-circuit voltage daily thereafter.

The test is considered completed when the closed-circuit voltage falls below 0.9 volt per cell. The service shall be reported as the number of hours of discharge to this cut-off voltage.

(3) *Flash-light 4-ohm continuous test.*—The cells and batteries shall be discharged continuously through a resistance of 4 ohms per cell.

The following readings shall be taken: Initial open-circuit voltage of the cell or battery. Initial closed-circuit voltage of the cell or battery. Closed-circuit voltage at half-hourly intervals until the voltage drops to 0.8 volt per cell, after which the readings shall be taken twice as often.

The test is considered completed when the closed-circuit voltage falls below 0.75 volt per cell. The service shall be reported as the number of minutes of the discharge to this cut-off voltage.

(c) **DELAYED SERVICE TESTS.**—The cells and batteries shall be stored on open circuit at an even temperature of approximately 20° C. (68° F.) for specified periods of time, after which they shall be discharged in accordance with the procedure for continuous tests.

(d) **RADIO C BATTERIES.**—The batteries shall be stored on open circuit at an even temperature of approximately 20° C. (68° F.), and voltage readings shall be taken at intervals of not exceeding one month.

The test is considered completed when the open-circuit voltage falls below 1.45 volts per cell. The service shall be reported as the number of months to this cut-off voltage.

XIII. REQUIRED PERFORMANCE

TABLE 7.—No. 6 dry cells

Type	Heavy intermittent test	Light intermittent test	Radio tests		Continuous test	Delayed service tests		
			Heavy	Light		3 months	6 months	9 months
General-purpose cells.....	Hours 60	Days 170	Hours	Hours	Hours 165	Hours 160	Hours 150	Hours 140
Telephone cells.....		220						
Radio cells.....			105	225	175	170	160	

NOTE.—Cells which are not specifically marked or sold as especially intended for telephone or radio service are to be tested as general-purpose cells.

TABLE 8.—Flash-light cells and batteries

Size of cell contained		Intermittent test	Continuous test	Delayed service tests		
Designation	Dimensions (in inches)			3 months	6 months	9 months
A.....	5/8 by 1 7/8	Minutes 60	Minutes 25	Minutes 20	Minutes 15	
B.....	3/4 by 2 1/8	130	65	55	45	
C.....	13/16 by 1 13/16	210	90	80	65	
D.....	1 1/4 by 2 1/4	500	380	350	320	290
E.....	1 1/4 by 2 1/4 (industrial type)		425	375		
F.....	1 1/4 by 2 7/8	750	550	500	450	400
	1 1/4 by 3 7/16	900	800	750	700	650

TABLE 9.—Radio B batteries

Size of cell contained		Intermittent tests, 5,000 ohms	Intermittent tests, 1,250 ohms		Continuous tests	Delayed service tests		
Designation	Dimensions (in inches)		Initial	3 months		3 months	6 months	9 months
		<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>
A-----	5/8 by 1 7/8-----	150	-----	-----	90	85	80	-----
B-----	3/4 by 2 1/8-----	300	-----	-----	225	210	200	-----
D-----	1 1/4 by 2 1/4-----	750	200	190	900	875	850	800
F-----	1 1/4 by 3 1/16-----	-----	400	375	1,700	1,650	1,600	1,550

TABLE 10.—Radio C batteries

Size of cell contained		Minimum required performance
Designation	Dimensions (in inches)	
B-----	3/4 by 2 1/8-----	<i>Months</i> 12
D-----	1 1/4 by 2 1/4-----	18



